# *Polhillia*, a new genus of papilionoid legumes endemic to South Africa

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Subgenus *Plecolobium* C.H. Stirton of *Lebeckia* Thunb., described originally to accommodate the unusual species *Lebeckia waltersii* C.H. Stirton, is broadened to include five species and is raised to generic rank as *Polhillia* C.H. Stirton based on the species *Polhillia waltersii* (C.H. Stirton) C.H. Stirton. The following new combinations are made: *Polhillia waltersii* (C.H. Stirton) C.H. Stirton and *P. connatum* (Harv.) C.H. Stirton. *P. pallens* C.H. Stirton and *P. canescens* C.H. Stirton are described as new.
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Die subgenus *Plecolobium* C.H. Stirton van *Lebeckia* Thunb., oorspronklik beskryf om die ongewone spesie *Lebeckia waltersii* C.H. Stirton te akkommodeer, word verbreed om vyf spesies in te sluit en word tot generiese rang as *Polhillia* C.H. Stirton verhoog, en is gebaseer op die spesie *Polhillia waltersii* (C.H. Stirton) C.H. Stirton. Die volgende nuwe kombinasies word gemaak: *Polhillia waltersii* (C.H. Stirton) C.H. Stirton en *P. connatum* (Harv.) C.H. Stirton. *P. pallens* C.H. Stirton en *P. canescens* C.H. Stirton word as nuut beskryf.
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**Keywords:** *Argyrolobium*, chemistry, new species, *Polhillia*

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## Introduction

*Lebeckia waltersii* C.H. Stirton is characterized by its plicate indehiscent fruits and its collared stipules adnate to the petiole and completely sheathing the stem. This rare plant is endemic to the renosterveld near Worcester where it grows on Table Mountain sandstone conglomerate (Stirton 1981a; van Wyk 1982). Until recently it was thought to comprise a monotypic subgenus of the genus *Lebeckia*.

When I described *L. waltersii* I established the subgenus *Plecolobium* to accommodate it. *L. waltersii* differs from all other species of *Lebeckia* in its sheathing stipules, plicate fruits and chromosome number, 2n = 32. In subgenus *Lebeckia* the stipules, if present, are linear, the fruits are flattened or inflated and the chromosome number is 2n = 18 (Dahlgren 1967; Polhill 1976; Goldblatt 1981).

The recent collection by Mr C. J. Burgers of excellent flowering and fruiting material of what is undoubtedly a new species, closely related to *L. waltersii*, has prompted me to re-evaluate the taxonomic position of subgenus *Plecolobium*. When I described *L. waltersii* I commented that I had referred it to *Lebeckia* notwithstanding the presence of prominent involucrate stipules unlike those in *Lebeckia*. The alternative was to have described a new monotypic genus but this I ruled out at the time because I was familiar with neither all the genera of the Crotalarieae nor the full range of the species occurring in southern Africa.

The discovery of Burgers' new species, which seems not to have been collected before, has forced me to reconsider the status of this species and *L. waltersii*. To this end I searched through all material of *Aspalathus, Bolusia, Buchenroedera, Crotalaria, Dichilus, Lotononis, Melolobium, Pearsonia, Rafnia, Tephrosia* and *Wiborgia*. I found only three species which seemed to merit a more detailed study: *Argyrolobium involucratum* (Thunb.) Harv. (*Psoralea involucrata* Thunb.), *Argyrolobium candicans* Eckl. & Zeyh. and *A. connatum* Harv.

*Argyrolobium candicans* Eckl. & Zeyh., unlike the other two species, has free stipules and a distinctive tubular androecium, features typical of *Argyrolobium*, so is excluded from further consideration.

*Argyrolobium connatum* Harv. is a little known endemic species from the Cape. It is unique among South African representatives of the genus *Argyrolobium* and is characterized by its involucrate stipules, conduplicate leaves and monadelphous androecium with the sheath split adaxially. It shares a number of features with *Lebeckia waltersii* and the new species collected by Mr Burger, as well as with another recent collection made by Mr B. Bayer which represents another distinct

undescribed species. All four species have involucrate stipules, conduplicate leaflets, a calyx akin to those found in *Melolobium* and *Dichilus*, and finally a distinctive androecial arrangement of 5 ovate versatile anthers alternating with 5 elongated basifixed anthers, but with the terminal anther identical to the other elongated basifixed anthers. This combination of characters constitutes a unique grouping within the tribe Crotalarieae. Whether this grouping consists of more than one genus is still unclear as there is so little material on which to base a decision. It is clear, however, that *L. waltersii*, and the species discovered by Mr Burgers together form a natural group, and that *Argyrolobium connatum* and the species discovered by Mr Bayer (which I am calling *P. canescens*) form another. For this reason I am broadening the concept of subgenus *Plecolobium* to include all four taxa and I am raising it to generic rank, adopting the name *Polhillia* in recognition of Dr R.M. Polhill's outstanding contribution to the study of the tribe Crotalarieae and to modern legume systematics.

*Argyrolobium involucratum* (Thunb.) Harv. has been transferred to *Melolobium: M. involucratum* (Thunb.) C.H. Stirton (Stirton, in press).

## Systematic position of *Polhillia*.

*Polhillia* has a natural affinity with *Melolobium* and *Dichilus*, two genera of the tribe Crotalarieae which have calyces with the three lower lobes joined into a relatively shortly toothed lip. Such a development occurs elsewhere in the tribe in the South American genus *Anarthrophyllum* and in most north temperate genera of the tribe Genisteae, but its occurrence in these is thought to be a parallel development (Polhill 1976).

The flowers of *Polhillia* are of an unspecialized type in the Crotalarieae. Standard appendages are absent, as in *Dichilus* and *Melolobium*, but the interlocking of wings and petals by infolded auricles is scarcely developed in the genus, rather there are some traces of a peg-pocket interlocking arrrangement. The filaments including the vexillary one are, as in most Crotalarieae, all joined higher up into a split sheath. *Polhillia* differs however from *Melolobium*, *Dichilus* and *Anarthrophyllum* in that the carinal anther is not intermediate in size, but is identical to the other four elongated basifixed ones. It should be pointed out that *Argyrolobium* generally has stamens united into a closed tube with an infrequent tendency for splits to occur on one or both sides of the vexillary filament (Polhill 1976).

Like most of the fruits in *Dichilus*, *Melolobium* and in some species of *Argyrolobium*, the fruits of *Polhillia* are narrowly oblong, flat and somewhat constricted between the seeds (except in *P. waltersii* which has plicate fruits), but differ in that all the former genera have dehiscent fruits.

## Cytology

Although there is considerable similarity between *Dichilus*, *Melolobium*, some species of *Argyrolobium* and *Polhillia*, this is not reflected in their respective chromosome numbers. Goldblatt (1981) attributes the following basic chromosome numbers, based on a few counts only, to these genera respectively: *Dichilus*, $x = 7$; *Melolobium*, $x = 9$ and *Argyrolobium*, $x = 8$ (with $n = 13, 15, 16, 24$). *Polhillia* has a basic number $x = 8$, based on two counts; $n = 16$ for *P. waltersii* (Brighton, in Stirton 1981a) and $2n = 32$ for *P. pallens* (Brandham, this paper). Of the above genera only *Argyrolobium* has $x = 8$. However, given that the Genisteae are perhaps the most cytologically complex tribe in the Leguminosae and that *Argyrolobium* is not only difficult to place unambiguously in either Crotalarieae or Genisteae, but has itself a complex genome, there is little else one can draw from the above data until further counts are made.

My overall impression is that *Polhillia* is a member of the Crotalarieae and that it is related to *Melolobium* and *Dichilus* (Crotalarieae).

## Biochemical evidence

Dr S.V. Evans, Jodrell Laboratory (Royal Botanic Gardens, Kew) has very kindly analysed alkaloids and amino acids of the seeds of eleven species of crotalarioid and genistoid legumes (Table 1). The aim of this preliminary analysis, based on all the available seed at our disposal, was to test whether biochemical evidence would support the various taxonomic

**Table 1** Vouchers for alkaloid and amino acid survey of selected species of the genera *Argyrolobium*, *Dichilus*, *Lebeckia*, *Melolobium* and *Polhillia*

| | Species | Voucher | Provenance |
|---|---|---|---|
| 1 | *Lebeckia spinescens* Harv. | Wasserfall 1114 | Kenhardt, Cape |
| 2 | *Lebeckia sericea* (L.) Thunb. | Goldblatt 4496 | Near Clanwilliam, Cape |
| 3 | *Dichilus strictus* E. Mey. | Codd 3681 | P.O. Vaalkrans, Transvaal |
| 4 | *Dichilus lebeckioides* DC. | Plant Protection Research Institute, Pretoria | Unknown |
| 5 | *Melolobium canescens* Benth. | Dinter 7882 | Namibia |
| 6 | *Melolobium microphyllum* E. Mey. | Pegler 1736 | Cala, Transkei |
| 7 | *Melolobium involucratum* (Thunb.) C.H. Stirton | Goldblatt 5531 | 64 km from Calvinia to Blomfontein on road to Middelpos, Cape |
| 8 | *Argyrolobium fischeri* Taub. | Anonymous | Nkhata Bay, Malawi |
| 9 | *Argyrolobium* sp. | Kirstenbosch Botanical Garden | Unknown |
| 10 | *Polhillia waltersii* (C.H. Stirton) C.H. Stirton | Walters s.n. | Worcester, Cape |
| 11 | *Polhillia pallens* C.H. Stirton | Burgers 2633 | 3 km west of Breede River mouth, Cape |

changes suggested on morphological grounds. The following data and conclusions were derived and made independently by Dr Evans without any prior knowledge of the taxonomy of the group. It should be emphasized, however, that this brief survey is merely an indicator for future studies as he had very little seed at his disposal.

The Genisteae and Crotalarieae are well known for the number, variety and biological importance of the alkaloids that they contain (Kinghorn and Smolenski 1981), and so were considered here for investigation.

*Methods and results*

The alkaloids present in the seeds were extracted into 75% EtOH and separated by TLC on silica gel plates with nBuOH - acetic acid - $H_2O$ (12 : 3 : 5). Dragendorff's reagent, which gives an orange colour on a yellow background, was used to detect the alkaloids (Figure 1).

The amino acid screen was carried out using the same extracts that were used for the alkaloid survey. Separation was by TLC as described above. Individual amino acids were detected using ninhydrin reagent (Figure 2). Finally, high voltage paper electrophoresis was employed to clarify any possible links detected above. Separation of the amino acids was carried out on a Whatman No. 1 paper using a pH 1,9, formic acid – acetic acid – water buffer (33 : 147 : 1820). Detection was made with ninhydrin (Figure 3).

*Discussion and conclusions*

It was impossible, because of the small amount of seed and the lack of available alkaloid standards, to draw any firm conclusions about the biochemical relationships between the 5 genera surveyed. Several patterns, however, did emerge from

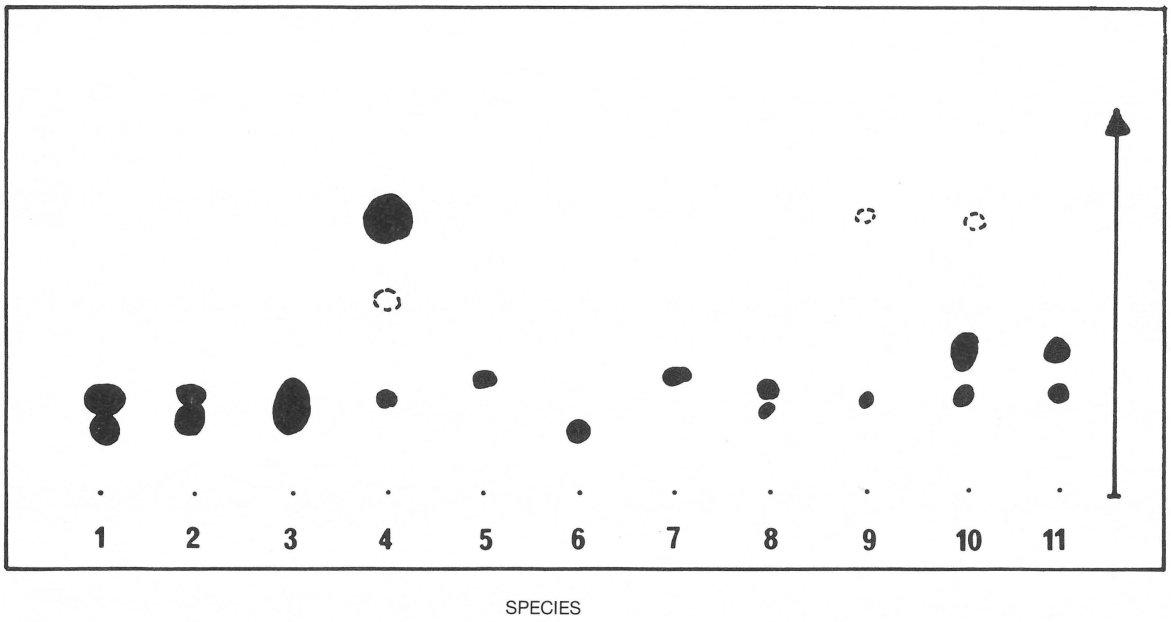


**Figure 1** Separation of alkaloids by TLC on silica gel plates with nBuOH — acetic acid — water (12:3:5). The seed samples used in *Dichilus strictus* and *Melolobium microphyllum* were too small to be reliable. Dragendorff's reagent used for spotting. For species see Table 1.

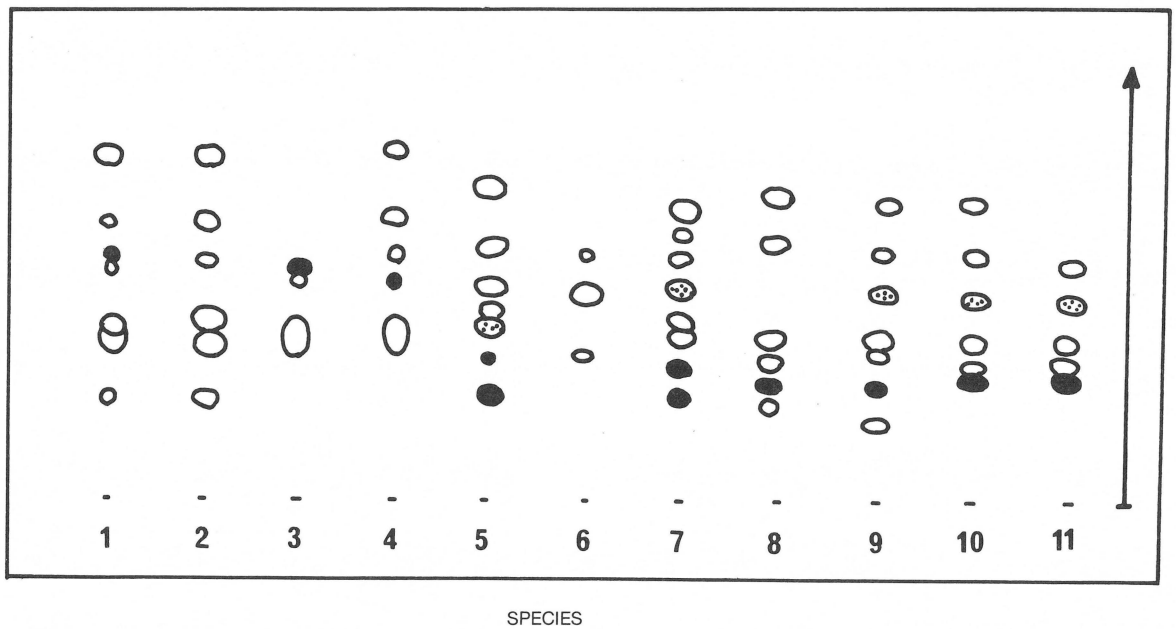


**Figure 2** Separation of amino acids by TLC on silica gel plates with nBuOH — acetic acid — water (12:3:5). Ninhydrin used for spotting. (○, purple; ●, yellow; ⊙, orange.) For species see Table 1.

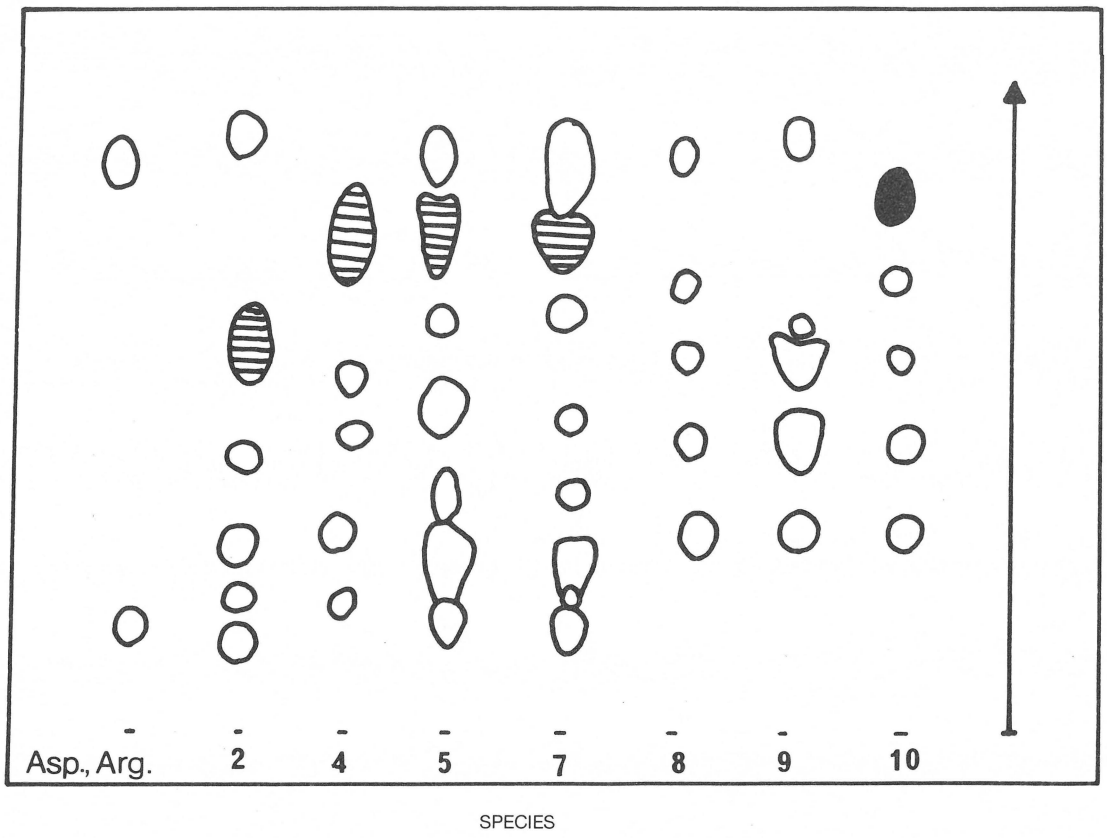


**Figure 3** Separation of amino acids by HVPC using pH 1,9, formic acid — acetic acid — water buffer (33:147:1820). Ninhydrin used for spotting (○, purple; ●, yellow; ⊖, grey). For species see Table 1.

the basic chemical data:

(i) Both *Lebeckia* species appear identical.

(ii) Alkaloid results show that the two species of *Dichilus* are dissimilar and that *D. strictus* seems closer to the *Lebeckia* species studied. The amino acid data also suggests that they are both fairly similar to the *Lebeckia* species.

(iii) *Melolobium microphyllum* cannot be commented on as too little seed was available. *M. canescens* and *M. involucratum*, however, are very similar (Figure 3). The results from the amino acid TLC suggest affinity to the other two pairs of *Argyrolobium* and *Polhillia* species.

(iv) Both species of *Polhillia* seem identical in biochemistry (Figures 1 & 3). However, (Figure 2), it seems that they are closer to *Argyrolobium* and *Melolobium* than to *Dichilus* or *Lebeckia*.

Dr Evans's conclusions indicate that this whole complex of genera, involving *Argyrolobium*, *Dichilus*, *Lebeckia*, *Melolobium* and *Polhillia*, contains enough biochemical variation to make a broader survey worthwhile. While cognizant that biochemical variation can be used to support almost any relationship, his preliminary survey does seem to support my transfer of *Argyrolobium involucratum* to *Melolobium* (Stirton, in press), my recognition of relationships between involucrate stipuled species of *Argyrolobium* to *Polhillia* and to *Melolobium*, and to some degree the distinctness of *Polhillia*. The suggested possible relationship between *Dichilus* and *Lebeckia* is an interesting one and should be considered by future students of these genera. The relationship of *Aspalathus* also needs to be considered.

## Key to *Polhillia* and related taxa

In the account that follows the terms used to describe petal sculpturing and seed morphology are taken from Stirton (1981b) and Putnam and Stirton (1986) respectively.

1a Stipules fused with the petiole and forming a cylindrical sheath around the stem; bracteoles absent:
  2a Leaves and stipules glabrous; flowers opening yellow, flushing purple; back of standard sericeous along midrib..... ***Melolobium involucratum***
  2b Leaves and stipules sericeous; flowers yellow; back of standard finely pubescent or densely sericeous all over .....***Polhillia***
1b Stipules absent, or if present, free and variously shaped or connate but not sheathing the stem; bracteoles present:
  3a Stipules absent; calyx distinctly shorter than the corolla; keel longer than the standard .....***Dichilus***
  3b Stipules present; calyx equal to or scarcely longer than the corolla; keel much shorter than the standard:
    4a Stipules semi-sagittate or semi-cordate at the base; calyx never deeply 2-lipped; plants more or less viscidulous or glandular .....***Melolobium***
    4b Stipules never lobed; calyx deeply 2-lipped; plants never viscidulous or glandular .....***Argyrolobium***

**Polhillia** *C.H. Stirton*, nom. et stat. nov.

*Lebeckia* Thunb. subgen. *Plecolobium* C.H. Stirton in Bothalia 13, 3–4: 318 (1981).

Type: *Polhillia waltersii* (C.H. Stirton) C.H. Stirton.

Small erect, much-branched shrubs up to 1,5 m tall. *Branches* rigid. *Branchlets* densely villous becoming smooth or lenticulate when old. *Leaves* digitately trifoliolate, shortly petiolate. *Stipules* 7–25 mm long, involucrate, adnate to the petiole, completely sheathing twigs and clasping the stem. *Leaflets* 4–14 mm long, 1–4 mm wide, terminal leaflet somewhat larger, obovate to narrowly obovate or narrowly elliptic to narrowly lanceolate, conduplicate, flattened only in juvenile plants and sp. A, subsessile, base acute or cuneate, apex acute or obtuse; densely silky. *Inflorescences* terminal on short shoots, 1–2(4)-flowered. *Flowers* 9–13 mm long, pale to

deep golden yellow, ebracteolate; pedicel 1 – 5 mm long; bracts small, linear-lanceolate. *Calyx* 4 – 10 mm long, shorter than the corolla, 2-lipped; upper lobes separate or somewhat united, triangular; lower lip formed from the fusion of the lateral and carinal lobes into a lip with three short teeth, fusion of the lobes being higher than that of the vexillar lobes. *Standard* 8,5 – 14 mm long, 9 – 13 mm wide, very broadly ovate, apex rounded or emarginate, claw less than half as long as the blade. *Wing petals* 10 – 14 mm long, 3,5 – 9 mm wide, more or less equal in length to the keel petals; both slightly pocketed, sculpturing upper basal and upper central or upper basal left central, intercostal, lunulate, becoming diffuse in patches or lunulate-lamellate. *Androecium* monadelphous, sheath split adaxially, consisting of 5 linear-oblong basifixed anthers (including the terminal anther) alternating with 5 ovate dorsifixed anthers. *Pistil* 7 – 10,5 mm long; ovary sessile or subsessile, compressed, densely hairy; ovules 7 – 10; style curving gently upwards to a small capitate stigma. *Fruits* 15 – 32 mm long, 3,5 – 5,5 mm wide, chartaceous, subsessile, narrowly oblong, sometimes slightly curved, plicate or flattened and impressed between the seeds, indehiscent. *Seeds* 2,3 – 3 mm long, 2,4 – 3 mm wide, dull, khaki to dark brown, hilum recessed. 2n = 32.

## Key to the species

1a Mature leaves conduplicate:
2a Calyx finely pubescent, vexillar teeth of calyx shortly and broadly triangular; stipules 1 – 3 mm long:
3a Foliage silvery; fruit flattened, impressed between seeds, shaggy; seeds dark brown, hilum round; flowers light yellow ..... 1. ***pallens***
3b Foliage silvery green; fruit plicate, finely pubescent; seeds khaki to greenish brown, hilum elliptic; flowers lemon to bright yellow ..... 2. ***waltersii***
2b Calyx densely sericeous, vexillar teeth of calyx narrowly triangular; stipules 7 – 11 mm long:
4a Pubescence of young shoots tawny; leaflets 1 – 2 mm wide; wing petals more or less equal in length to the keel; calyx 6 – 7 mm long ..... 3. ***connatum***
4b Pubescence of young shoots silvery; leaflets 3,5 – 4 mm wide; wing petals longer than the keel, calyx 9 – 10 mm long ..... 4. ***canescens***
1b Mature leaves flattened ..... 5. ***sp. A***

**1. Polhillia pallens** *C.H. Stirton*, sp. nov., *P. waltersii* (C.H. Stirton) C.H. Stirton similis foliis argyreis, floribus pallide flavis, fructibus anguste oblongis haud plicatis saturate brunneis usque nigris molliter villosis, seminibus saturate brunneis, hilo rotundato, cellulis testae ordinationem reticulatem formantibus, et parietibus valde incrassatis differt.

TYPUS. — Cape Province: 3 km west of Breede River mouth on south side of river along access road to Kontiki, 22/2/1981, *Burgers 2633* (STE, holotypus; K, STE, isotypi). (Figure 4).

Erect multistemmed shrub up to 1 m high. *Bark* dull brown, prominently lenticelled. *Stipules* 20 – 25 mm long, fused, villous. *Leaflets* 5 – 6 mm long, 1,5 – 2 mm wide (juvenile plants have larger leaflets, from 8 – 13 mm long, 4 – 5 mm wide), terminal leaflet slightly longer, obovate becoming narrowly obovate in mature plants, slightly arcuate, base cuneate, apex obtuse, conduplicate but often flat in juvenile plants, densely sericeous. *Inflorescences* 1 – 2-flowered. *Flowers* 9 – 10 mm long, pale yellow, each flower subtended by a small erect bract, ebracteolate; pedicel 1 – 2 mm long, tapering. *Calyx* 6 mm long, including tube 4 mm long; vexillar teeth triangular, 1,5 mm long, almost equally broad at the base; lateral and keel lobes mutually coherent to a lip, narrower and shorter than the vexillar teeth, downy outside, glabrous inside. *Standard* 10 mm long, 9 mm wide, claw 3 mm long, blade emarginate, sericeous on back. *Wing petals* 10 – 11 mm long, 3,5 – 4 mm wide, claw 4 mm long, curved, scarcely auriculate, gibbous, widest in middle, equal in length to keel petals, indented on base line; sculpturing upper basal and left central, finely lamellate-lunulate. *Keel petals* 10 mm long, blade 6 mm long, claw 4 mm long, fused from apex for one-third their length along the lower margins, auriculate, pocketed near the base. *Androecium* 10 mm long, stamens sheathed, open on upper side, anthers markedly dimorphic, alternately elongate and basifixed, 1,5 – 1,6 mm long, then short and dorsifixed, 0,7 mm long, the shorter anthers developing later than the longer anthers and eventually overtopping them. *Pistil* 10 mm long; ovary 7 mm long, linear, flattened, subsessile, densely pubescent merging into upcurved style; style erect, directed forwards, height of curvature 5 mm; stigma terminal,

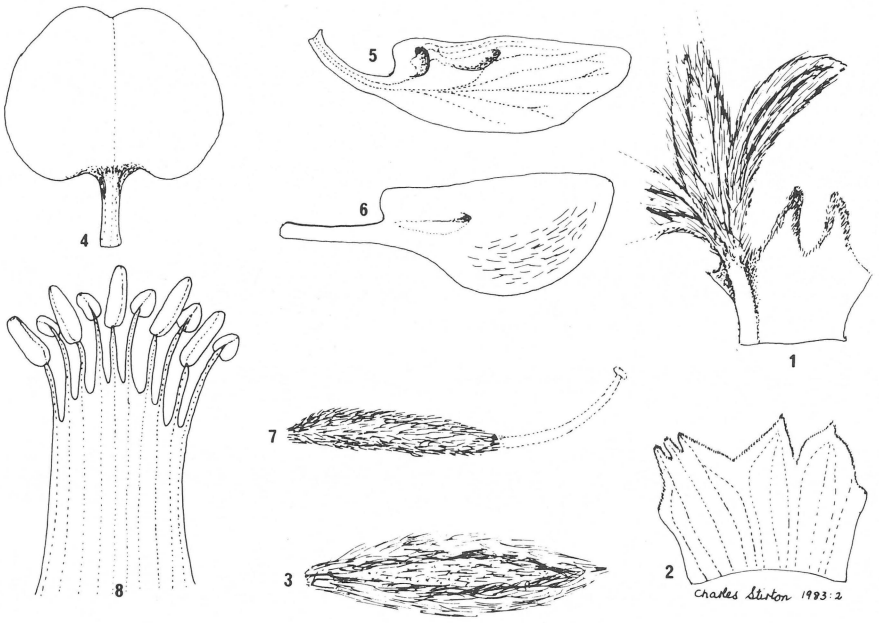


**Figure 4** *Polhillia pallens* C.H. Stirton (*Burgers 2633*). 1, Involucrate stipule opened out and showing fusion of petiole to it, ×5; 2, calyx opened out, ×4; 3, conduplicate terminal leaflet, ×5; 4, standard, ×3; 5, wing petal, ×4; 6, keel petal, ×4; 7, pistil, ×4,5; 8, upper portion of androecium, ×8.

fibrillose, peripheral elements longest and arcuate; ovules 7 – 8. *Fruits* 26 – 32 mm long, 5 – 5,5 mm wide, dark brown to black but appearing grey owing to the dense covering of soft villous hairs; somewhat constricted between the seeds. *Seeds* 2,8 – 2,9 mm long, 2,4 – 2,6 mm wide, 2 – 2,2 mm thick, testa simple-reticulate with heavy ridges, sheen dull, dark brown, slightly reniform, transverse section elliptic; hilum round, recessed, sub-terminal or off-centre, rim aril inconspicuous and irregular, micropyle hidden; tracheid bar narrowly ovate, vesturing of tracheoids unbranched micoid; cotyledons with inflexed embryonic axis; cotyledon-radicle junction plain, radicle greater than half the length of the seed; endosperm present; interfaces curved, sides rounded. (2n = 32, count by P. Brandham; voucher *Burgers 2633*). (Figures 5 & 6).

*Polhillia pallens* is a rare endemic collected for the first time in 1981. It was found growing by Mr C.J. Burgers, at an altitude of 30 m and with a SW aspect, in renosterveld on low hills of Bokkeveld shale (Figure 7). The species tends to favour deep clay sites. At the Potberg site the shrublets resprouted after fires in January and February of 1983. The colony sampled (*Burgers 3129*) comprised 70 plants. Seedling regeneration was observed after a fire in January 1983. In this locality *P. pallens* was associated with small-leaved shrubland species such as *Relhania garnotii, R. genistiifolia* and *Felicia* sp. (Burgers pers. comm, 1983). The Witkop colony comprised about 20 plants. It should be stressed that all the known populations of *P. pallens* are very small and that these occur in remnant patches of renosterveld, the patchwork due to large-scale ploughing for wheat fields.

The main flowering season seems to be in August – September (October), supplemented in some years with irregular flowering in February dependent on the rainfall.

Mr Burgers has spared no effort in obtaining new records of this species and in providing me with colour transparencies and viable seed. I am indeed very grateful to him for sending me this material and for continuing to search so diligently for rarely collected endemic legumes. He has sent seed of this critically endangered species as well as of *P. waltersii* and *P. canescens* to the Bolus Herbarium Germplasm Bank.


**Figure 5** *Polhillia pallens* C.H. Stirton. 1, Close-up of flowers and fruit showing involucrate stipules, narrowly oblong slightly arching fruit and conduplicate digitately trifoliolate leaves (*Burgers 3212*, from Witkop). 2. Habit after fires had swept the area six months earlier (*Burgers 3129*). Photographs C.J. Burgers.

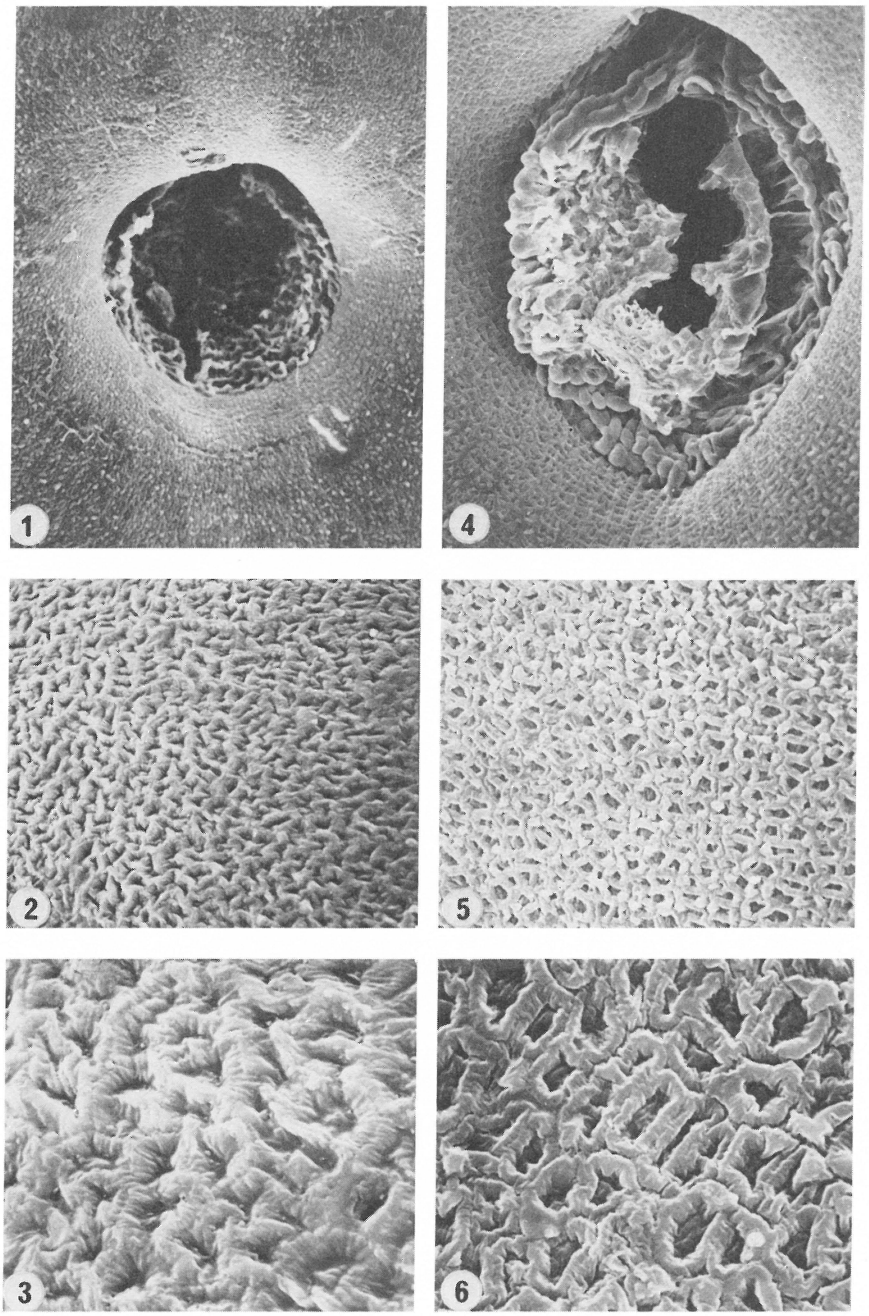


**Figure 6** Seed features of *Polhillia pallens* (1 – 3, *Burgers 2633*) and *P. waltersii* (4 – 6, *Walters s.n.*). 1, Round, recessed hilum and hidden micropyle, × 145; 2 – 3, simple-reticulate testa with heavy ridges, × 360 and × 1000. 4, Elliptic recessed hilum with hidden micropyle, remnant of funiculus clearly visible, × 145; 5 – 6, simple reticulate testa, × 360 and × 1000. Photomicrographs taken using a JEOL-JSM-T20 scanning electron microscope operating at 20 kv, recorded on polaroid type 665 film. Specimens coated for 2 min with platinum in a Balzer splutter coater.

## Material examined

—**3420** (Bredasdorp): Witkop, 15 km ESE of Stormsvlei (– AA), 1/10/83, *Burgers 3212* (K, STE); Luipaardskop farm at northern foothills of Suikerkankop (– AD), 2/10/83, *Burgers 3197* (K, STE); Potberg Nature Reserve, 1,5 km due west of Potberg Education Centre (– BC), 1/9/83, *Burgers 3129* (K, STE); 3 km west of Breede River mouth on south side of river along access road to Kontiki (– BD), 22/2/81, *Burgers 2633* (K, STE).

**2. Polhillia waltersii** (*C.H. Stirton*) *C.H. Stirton*, comb. nov.

*Lebeckia waltersii* C.H. Stirton in Bothalia 13, 3 – 4: 318 (1981).

TYPUS. — Cape Province: Worcester commonage, *Rourke 1484* (K, holotypus!; AAU, MO, NBG, S, STE, isotypi).

Erect much branched shrub 50 – 70 cm high. *Stipules* becoming bifurcate in leaves that subtend inflorescences, sericeous. *Leaflets* 4 – 10 mm long, 1,5 – 2 mm wide, subsessile, equal, narrowly obovate, somewhat recurved, base cuneate, apex obtuse, conduplicate, rarely flattened, sericeous. *Inflorescences* terminal on short lateral branches, 1 – 3-flowered. *Flowers* 10 mm long, bright yellow, each subtended by a very small erect bract, ebracteolate; pedicel 3 – 5 mm long. *Calyx* 4 mm long; triangular teeth shorter than the 3 mm tube; vexillar lobes less fused than the lateral and keel lobes; finely pubescent outside, glabrous inside. *Standard* 8,5 mm long, up to 9,5 mm wide, claw 3 mm long, very broadly ovate, auricles and appendages absent, apex emarginate, back silky. *Wing petals* 10,5 mm long, 4 mm wide, claw 3 mm long, cultrate, sparsely pubescent, equal in length to keel; sculpturing upper basal

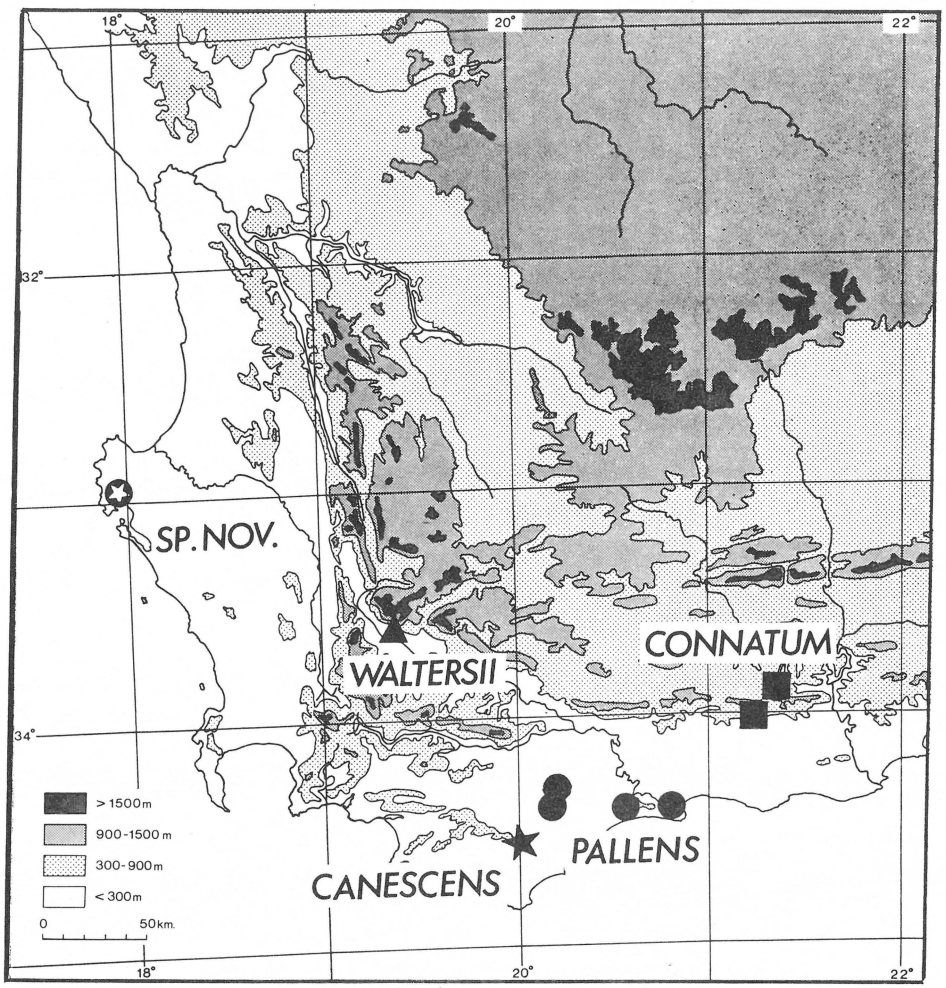


**Figure 7** Known distribution of *Polhillia waltersii* ●, *P. pallens* ▲, *P. sp*? ✪, *P. connatum* ■, and *P. canescens* ★.

and left central, finely lamellate-lunulate; auriculate. *Keel petals* 9,5 mm long, 3,5 mm wide, fused from apex for one-third their length along the lower margins; auriculate, pocketed near the claw junction. *Androecium* 8 – 9 mm long, stamens sheathed, slit on upper side. *Pistil* 7 – 8 mm long, 3,5 mm wide, subsessile, compressed and most hairy above and below, sparsely laterally; style erect, glabrous, forward sloping, height of curvature 2,5 – 3 mm; stigma minute, fibrillose. *Fruit* 15 – 20 mm long, 4 – 5 mm wide, narrowly oblong, plicate, somewhat woody, often persisting on the plant for up to six months before dropping to the ground; finely pubescent. *Seeds* 3 mm long and wide, testa simple-reticulate, sheen dull, khaki to greenish brown, reniform, transverse section elliptic; hilum elliptic, recessed, off-centre; rim aril reduced, visible; micropyle deltoid, hidden, adjacent to hilum, tracheid bar narrowly ovate; vesturing of tracheoids unbranched, micoid; cotyledons with inflexed embryonic axis; cotyledon — radicle junction plain, radicle greater than half the length of seed, endosperm present. (Figures 8 & 9).

*Polhillia waltersii* is endemic to the south-western Cape (Figure 7) and is found growing on hard clay soils in mixed succulent renosterveld on Table Mountain sandstone conglomerate in association with *Elytropappus rhinocerotis, Pteronia* sp. and species of *Mesembryanthemum*. Flowering has been recorded in July, August, September, January and February.

The localized distribution of this species is probably accounted for, as with the other species of *Polhillia*, by the indehiscent nature of the fruits, their tardy adherence to the plants and their eventual fall to the immediate vicinity of the bushes. A census carried out on 2/9/1981 by Messrs C.J. Burgers and M. Brett of the population on the Worcester commonage recorded 260 flowering plants of this species.

Seed germination is epigeal and occurs in 4 – 5 days if the testa has been suitably scarified.

## Material examined

— **3319** (Worcester): Worcester (– CB), 28/9/1978, *Esterhuysen 35048* (BOL, K); *Rourke 1484* (AAU, K, MO, NBG, PRE, S, STE); 8/7/1977 and 20/7/1977, *Walters s.n.* (K, NBG); 1 km from Worcester on road to Cape Town (– CB), 22/1/1981, *Burgers 2616*; 26/2/1981, *Burgers 2636* (STE); 18/9/1981, *Stirton 9134*.

### 3. Polhillia connatum (*Harv.*) *C.H. Stirton*, comb. nov.

*Argyrolobium connatum* Harv., Fl. Cap. 2: 72 (1862). Type: Cap. Bon. Spei, without precise locality, *Thom 37* (K, holotypus!).

*Genista connata* (Harv.) Briq., Etud. Cytises Alp. Marit. 119 (1893).

Small erect much-branched shrublet, densely silky, mostly tawny. *Bark* smooth, shiny, blotched yellow-brown. *Stipules* 7 – 8 mm long, broad based, deltoid, fused, sharply bifid, villous outside, finely pubescent on inner face of teeth, rest glabrous. *Leaflets* 8 – 9 mm long, 1 – 2 mm wide, subsessile, terminal leaflet larger, narrowly elliptic to narrowly lanceolate, base and apex acute, conduplicate, densely silky on both faces. *Inflorescences* 2 – 4-flowered. *Flowers* 10 – 11 mm long, colour unknown, probably yellow, ebracteolate; pedicel 1 – 2 mm long, tapering. *Calyx* 6 – 7 mm long, in-

cluding tube 4 mm long; vexillar teeth 2 mm long, equally broad at base, sinus rounded; lateral and keel lobes mutually coherent to a tripartite lip, narrower and slightly shorter than the vexillar teeth, glabrous inside, densely silky outside. *Standard* 10 – 11 mm long, 9 – 10 mm wide, claw 4 mm long; blade very broadly ovate, apex rounded to obtuse, densely silky over the entire back. *Wing petals* 12 – 13 mm long, blade 9 mm wide, claw 4 mm long; more or less equal in size to the keel, slightly auriculate, cultrate; sculpturing upper basal and upper central, intercostal, thickly lunulate becoming diffuse in patches. *Keel petals* fused from apex for one-third their length along the lower margins; blade 6 – 6,5 mm long, 3,5 – 4 mm wide, slightly auriculate, shallowly pocketed near junction with the claw. *Androecium* 9 – 10 mm long, monadelphous, slit on adaxial side. *Pistil* 9 – 10 mm long, linear, compressed, subsessile; villous, merging into upcurving style; stigma terminal, small. *Fruits* and seed unknown. (Figure 10).

*Polhillia connatum* is still shrouded in problems. We do not know where the type specimen was collected, and there is still some doubt as to whether *Muir 2803* and *Muir 3745* should be included in the species.

I have tried to trace the type locality — and presume, given the low putative collecting number 37 (Figure 11), that the rather depauperate specimen was probably collected by the Rev George Thom, during 1821-1823, in the Caledon area where he served as a minister of the Nederduitse Gereformeerde Kerk until August 1825. This presents a problem, however, as the other two specimens, more robust with larger flowers, are distributed well to the east of the presumed type locality. Collectors should keep a look out for this species in the intervening areas and should recollect the species from its known distribution range.

The Director's correspondence at Kew (Vol 58, Letters Africa, 1830 – 1844) contains three letters sent by George Thom (Figure 12) to W.J. Hooker. No. 216, written in Caledon and dated 10th January 1824 was shipped from Cape Town on 5th March 1824, and includes an abbreviated list of specimens sent by Thom to Hooker via Professor Couper at the Glasgow Hunterian Museum. This letter arrived in Glasgow on June 18th, 1824. No. 217 is dated June 22nd,

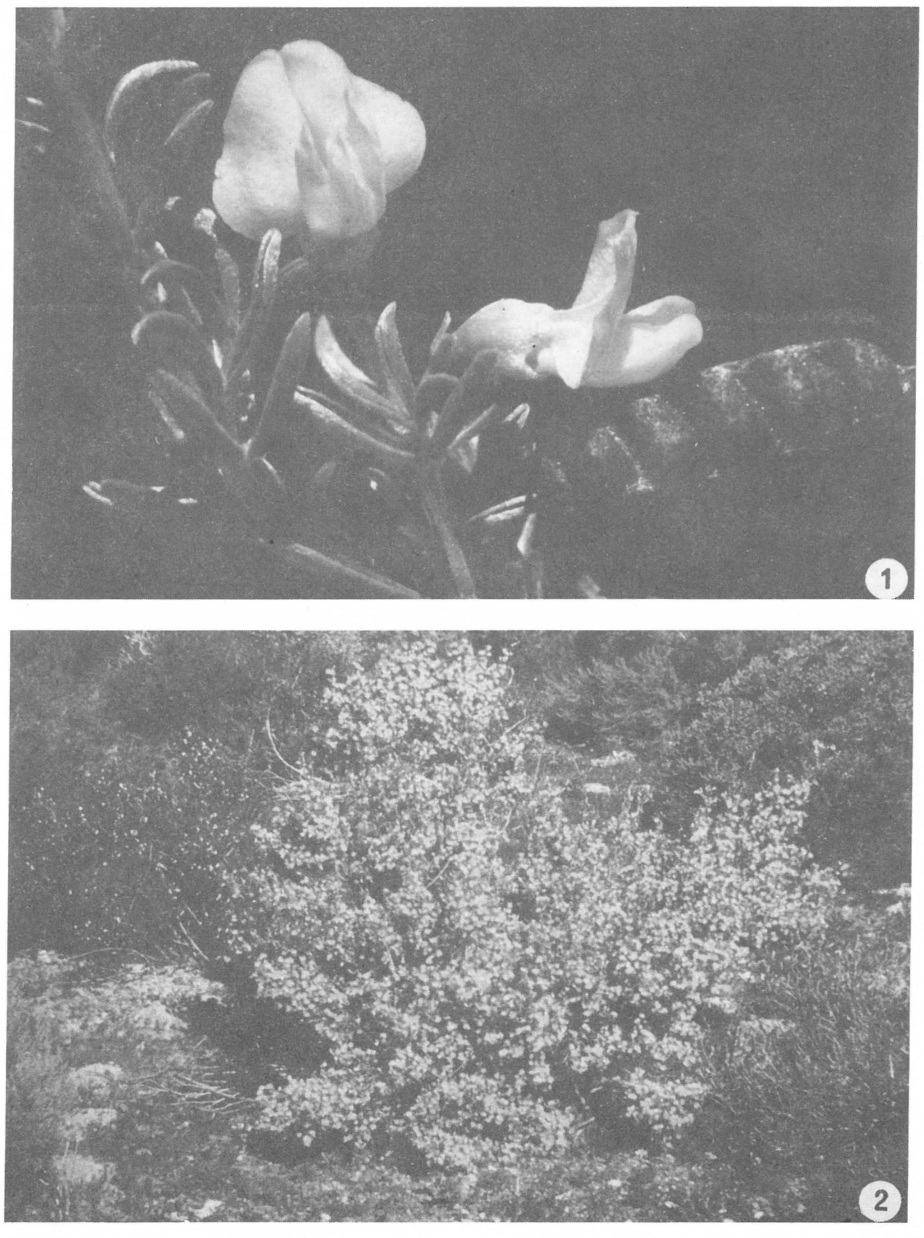


**Figure 8** *Polhillia waltersii* (C.H. Stirton) C.H. Stirton. 1, Close-up of flowers and fruit showing short distinctively plicate fruit, conduplicate leaves and solitary flowers borne in leaf axils at the end of a short shoot (*Burgers 2636*, from Worcester). 2, Flowering shrub in natural habitat, photographed near Worcester West. Photographs C.J. Burgers.

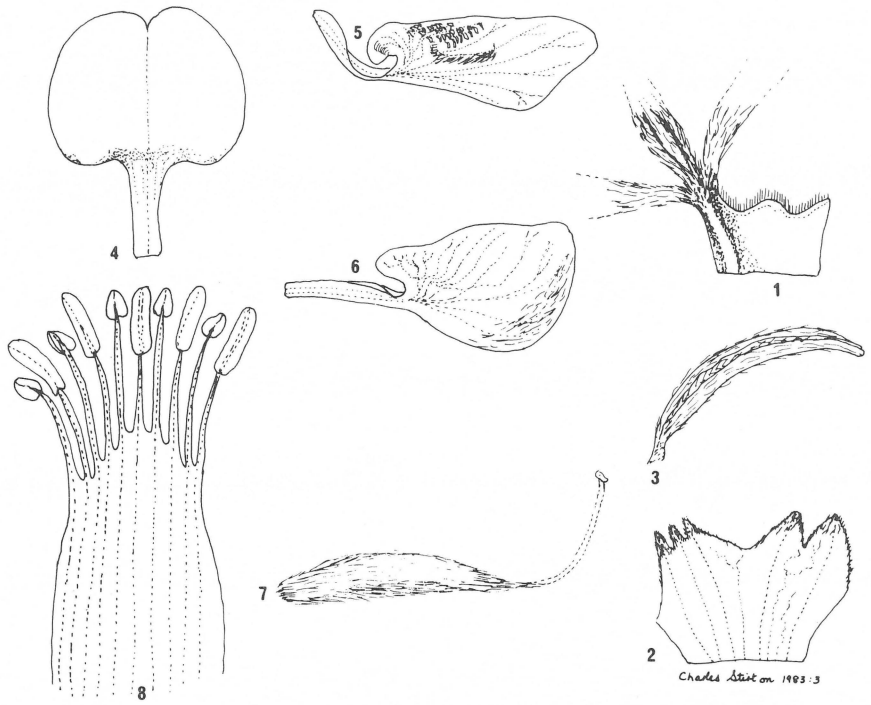


**Figure 9** *Polhillia waltersii* (C.H. Stirton) C.H. Stirton (*Walters s.n.*, K). 1, Fused stipules subtending digitately trifoliolate leaf, ×6; 2, calyx opened out, inner surface, ×4; 3, terminal leaflet, ×6; 4, standard, ×3,3; 5, wing petal, ×4; 6, keel petal, ×4; 7, pistil, ×4; 8, androecium, ×11.

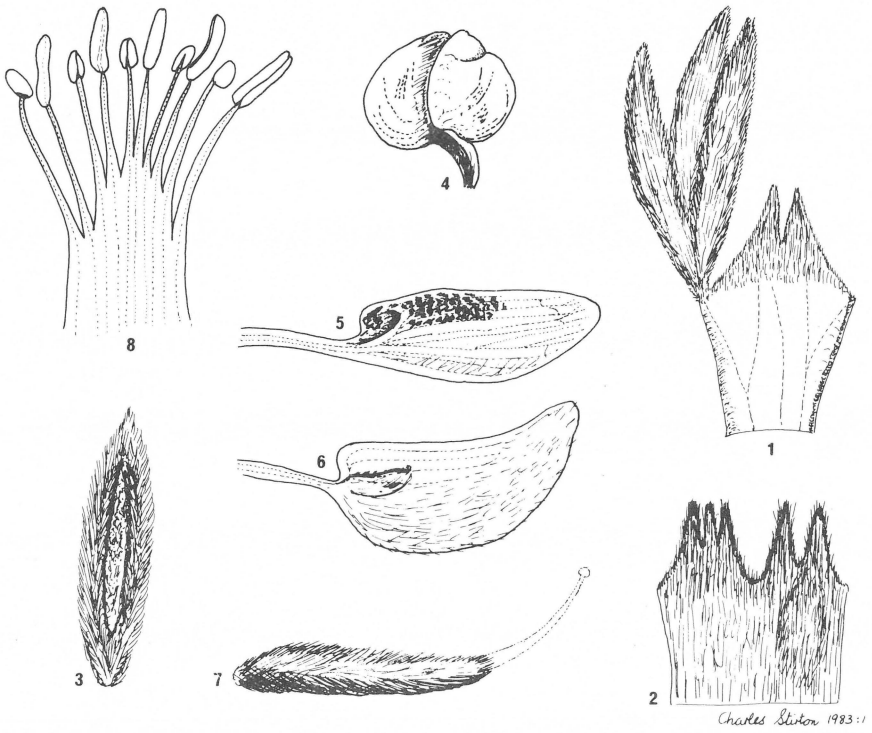


**Figure 10** *Polhillia connatum* Harv. (*Thom 37*). 1, Involucrate stipule opened out and showing fusion of petiole to it, ×4; 2, calyx opened out, ×3,5. 3, abaxial surface of leaflets, ×4,5. 4, standard, ×2; 5, wing petal, ×4; 6, keel petal, ×4; 7, pistil, ×4; 8, apex of androecium, ×8.

1826 and was posted from the Tulbagh Post Office arriving in Glasgow on September 20th, 1826. It lists localities for specimens 850 – 1033. No. 218 is dated May 21st, 1827, and was sent from Tulbagh being shipped from Cape Town on 2nd June 1827 arriving in Glasgow on August 10th, 1827. This is a list of his specimens collected between 1824 and 1825, number 1034 – 1357, and localities annotated by W.J. Hooker. There is no correspondence in Kew appertaining to his earliest collections. I would be most interested therefore to hear from anyone who has access to any of Thom's letters from W.J. Hooker or of any letters from G. Thom to botanical or geological correspondents in Europe or locally in the Cape of Good Hope. Of particular interest would be a list of his specimens numbered 1 – 849.

## Material examined

— **3321** (Ladismith): Hills at Waterval in Klein Karoo, north of Langeberg (– CD), Sept. 1925, *Muir 3745* (BOL, PRE).

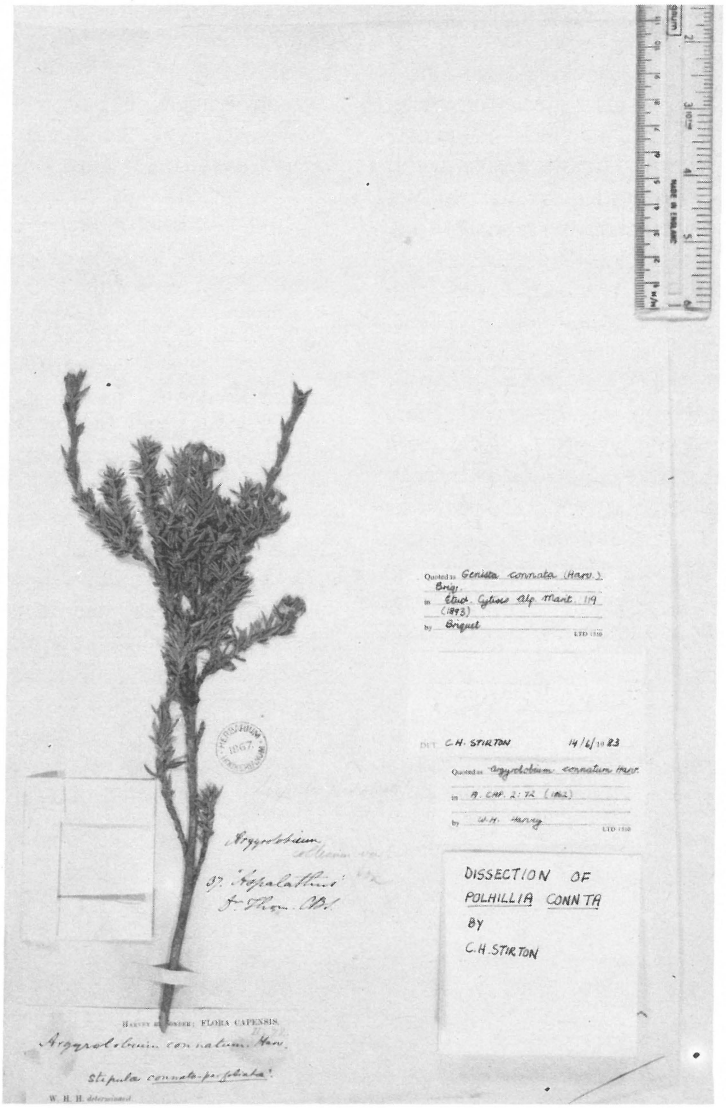


**Figure 11** Holotype of *Argyrolobium connatum* Harv. (*Thom 37*).

— **3421** (Riversdale): Hills near Riversdale (– AB), October 1923, *Muir 2803* (BOL); flats near Riversdale (– AB), October 1923, *Muir 2817* (PRE).
Without precise locality: *Thom 37* (K).

**4. Polhillia canescens** *C.H. Stirton*, sp. nov.

Frutex erectus usque 1,5 mm altus. *Rami* cani. *Folia* digitate trifoliolata. *Foliola* (8) 10 – 13(14) mm longa, 3,5 – 4 mm lata plana, anguste oblongata atque ramulos omnino vaginantes. *Infloresentia* 1 – 3-flora, axillare. *Flores* 12 – 13 mm longi, luteoli, pedicello 2 – 4 mm longo. *Calycis dentes* tubum aequantes, lobis vexillaribus maxime, fissis. *Vexillum* 14 mm longum, 13 mm latum, late ovatum, unguiculatum dorso sericeum. *Alae* carina longiores. *Androecium* monadelphum, adaxialiter fissum.

TYPUS: — Cape Province: Adamskop, north of Bredasdorp, 23/9/1982, *Bayer 3104* (NBG, holotypus!)

Erect to semi-erect shrub up to 1,5 m tall, canescent, coppicing after fire or damage. *Branches* few, greyish, finely fissured on older parts becoming glabrescent; densely shaggy on short shoots. *Stipules* 7 – 14 mm long, narrower at base, fused, shortly bifid, teeth triangular; villous outside, inside glabrous except for teeth. *Leaflets* (8) 10 – 13 (14) mm long, 3,5 – 4 mm wide, subsessile, terminal leaflet larger, narrowly oblong to narrowly elliptic when flattened out, conduplicate when fresh, base cuneate, apex acute; densely canescent. *Inflorescences* in

**Figure 12** Photograph of a postcard portrait of Rev George Thom. Original loaned kindly by Mrs M.K. Payne, Curatrix, Oude Kerk Volksmuseum. Photograph taken by M. Svanderlik, original by A. Runge.

axils of last few leaves of short shoots, 1 – 3-flowered. *Flowers* 12 – 13 mm long, deep golden yellow, ebracteolate; pedicel 2 – 4 mm long. *Calyx* 9 – 10 mm long, including the tube 5 mm long; vexillar teeth 2,0 – 2,2 mm long, base with rounded sinus, lateral and keel lobes mutually coherent to a tripartite lip, teeth narrower and slightly shorter than the vexillar teeth; glabrous inside, densely canescent outside. *Standard* 14 mm long, 13 mm wide, claw 4 mm long, blade very broadly ovate, apex emarginate, silky over entire back. *Wing petals* 14 – 15 mm long, blade 5 mm wide, claw 5 mm long, longer than the keel; claw twisted; broadly cultrate; sculpturing upper basal and upper central, intracostal, finely lunulate becoming diffuse; midline of billowing blade finely pubescent, auricle and upper basal edge infolded. *Keel petals* 10 mm long, blade 6,5 – 7 mm wide, claw 4,5 – 5 mm long; abruptly curved, fused from point of flexure to apex; slightly pocketed; densely pubescent. *Androecium* 12 mm long, monadelphous, slit on adaxial side; terminal anther linear-oblong. *Pistil* 10 – 10,5 mm long, curved, tapering into style, flattened, villous; style erect, tip incurved somewhat, height of curvature 6 – 7 mm; stigma small, capitate. *Ovules* 10. *Fruits* and seeds unknown. (Figures 13 & 14).

## Distribution and biology

This distinctive legume appears to be endemic to coastal renosterveld in the Bredasdorp area. (Figure 7). Bayer's two collections were made within 3 km of each other in a remarkably species-rich area, in vegetation typical of the remaining islands of the northern Bredasdorp area. This vegetation includes elements like *Aloe ferox* at its south-western limit, *Haworthia marginata* a south-western Cape endemic, *Gibbaeum austricolum* Glen (in mss.) etc.

## Specimens examined

— **3420** (Bredasdorp): Rooivlei (– AC), 16/10/1982, *Bayer 3183* (NBG, PRE); Rooivlei Hill, 18 km NE of Bredasdorp along road to Swellendam, 25/4/1984, *Burgers 3238* (K, STE,); Adamskop, north of Bredasdorp (– AC), 23/9/1982, *Bayer 3104* (NBG).

**5. Polhillia** sp. A.

In a previous paper (Stirton 1981a) I mentioned the occurrence of an anomalous specimen, *Hutchinson 253* (K), which I attributed to *Lebeckia waltersii* C.H. Stirton. This taxon differs from *L. waltersii* in its non-conduplicate wider leaflets, larger inflorescence, and involucrate but less prominent stipules. I included it tentatively under *L. waltersii* until such time as fruits and seeds had been collected. The only flowering specimen was collected between Vredenburg and Hoodjiesbaai on 5th September. Unfortunately Hutchinson (1946) was not particularly impressed by the plant as he does not mention it in his book 'A botanist in Southern Africa'.

Recent industrial and agricultural developments in its area of occurrence would mitigate against its continued survival.

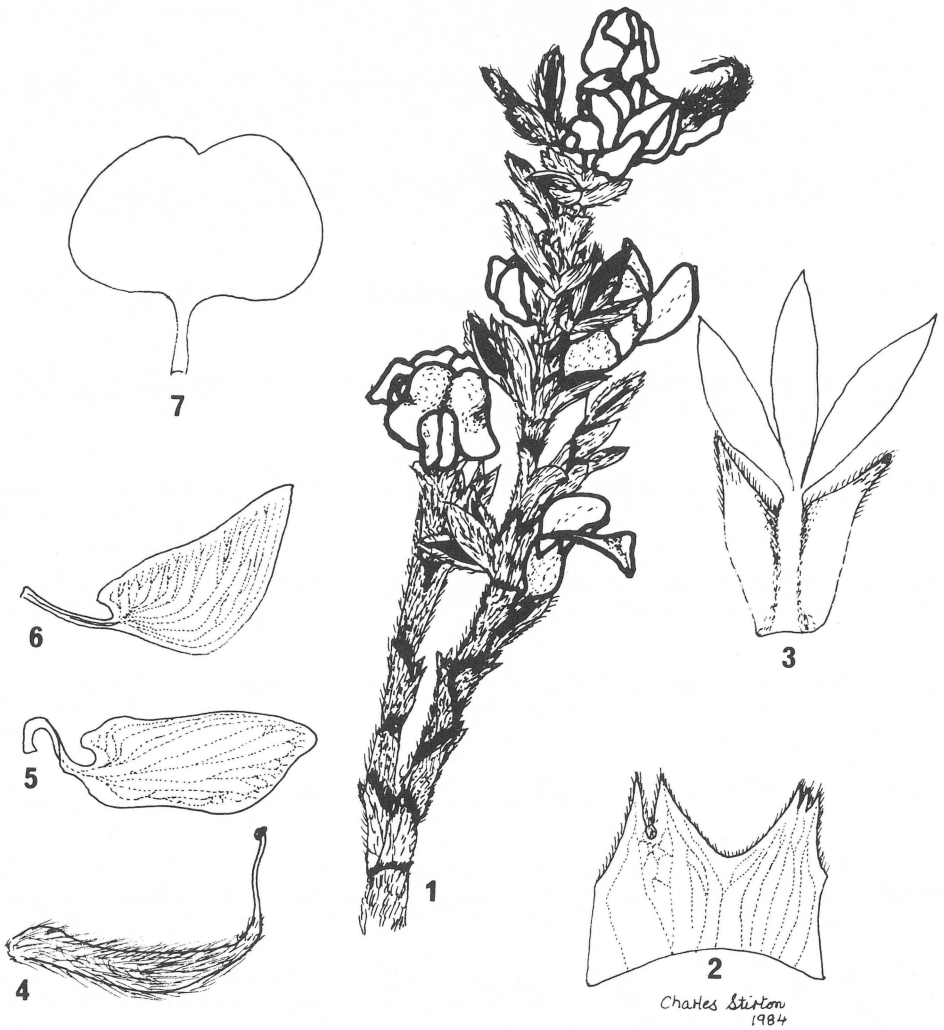


**Figure 13** *Polhillia canescens* C.H. Stirton (*Bayer 3183*). 1, Flowering shoot, ×1; 2, calyx opened out, ×2,8; 3, involucrate stipule split open and showing fusion of petiole to fused stipules, ×2,5; 4, pistil, ×3; 5, wing petal, ×3; 6, keel, ×3; 7, standard ×3.

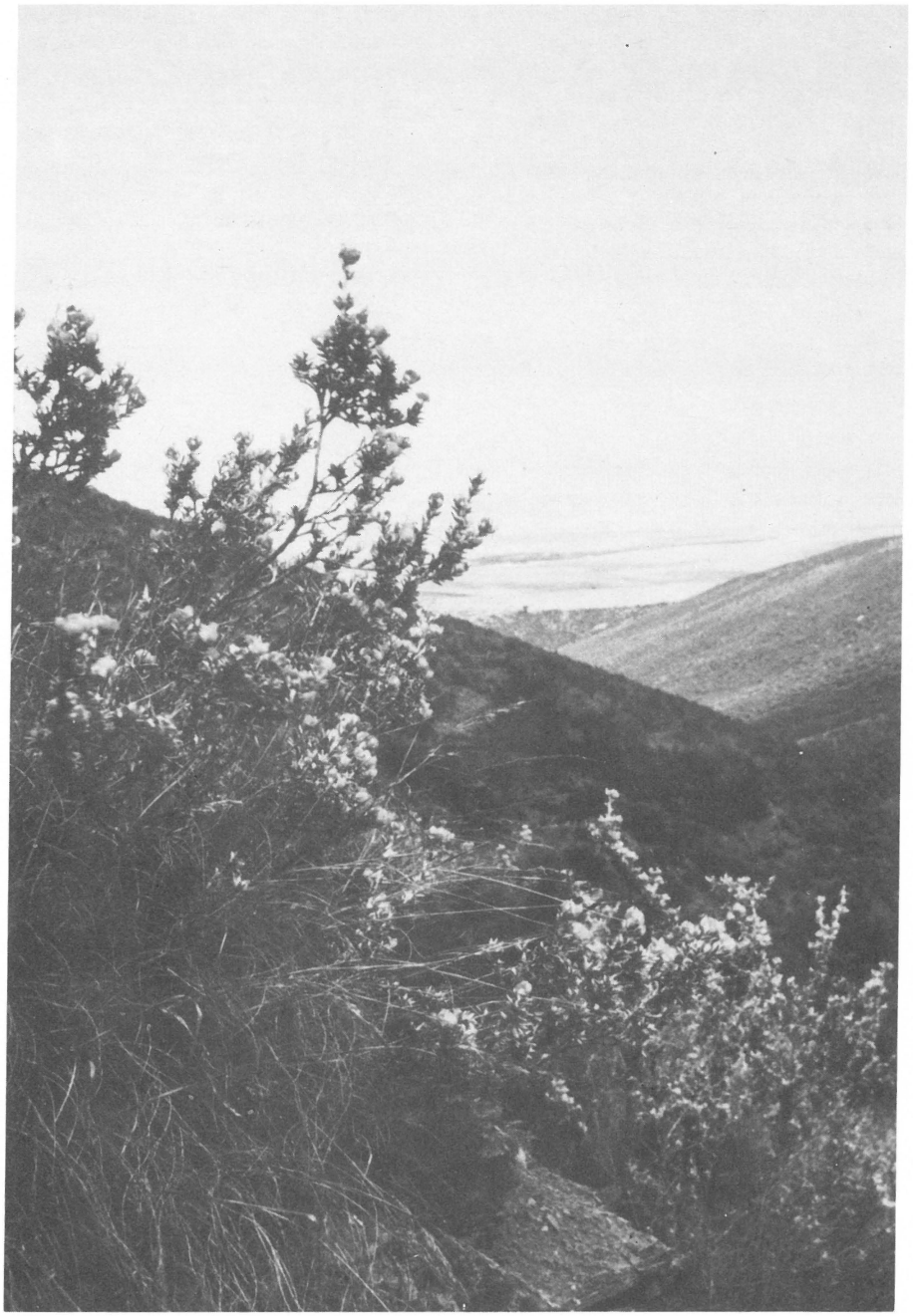

**Figure 14** Habit and habitat of *Polhillia canescens* (*Bayer 3104*). Photograph B. Bayer.

Collectors are urged nonetheless to look out for this plant lest it becomes extinct before its taxonomic identity can be established. It could probably be found fruiting in late September to early October.

## Acknowledgements

I wish to thank the following people from the Royal Botanic Gardens, Kew: Dr B. Verdcourt for kindly providing the Latin diagnoses; Dr R.M. Polhill for informative discussions about generic limits in the Crotalarieae and Genisteae; Dr I.K. Ferguson for allowing me to use his Unit's JEOL-JSM-T20 Scanning Electron Microscope; Dr P. Brandham for counting the chromosome numbers of *Polhillia pallens* and finally to Mr M. Svanderlik of the Photography Department for printing the photographs from colour slides. I would also like to thank Mr C.J. Burgers (Dept. of Nature & Environmental Conservation, Stellenbosch, Cape) for drawing my attention to *Polhillia pallens*; the late Dr I. Walters (Worcester, Cape) and Mrs H. Walters for their hospitality, keen interest and comments on *P. waltersii*; Mr M.B. Bayer (Karoo Botanic Garden) for kindly lending me colour transparencies and for information on *P. canescens*; Mrs M.K. Payne, Curatrix of the Oude Kerk Volksmuseum (Tulbagh) for the loan of an original photograph of George Thom, and for permission to publish it; Dr R. Dahlgren (Copenhagen) for reading the manuscript and finally to the Curators of BOL, NBG, K, and PRE who kindly allowed me access to their material of *Polhillia*.

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